

WHAT IS CLAIMED IS:

1. A mesoporous inorganic material having an ordered array structure of a plurality of one-dimensional pores, wherein the entrances of said pores have a functional group capable of forming a bond based on a chemical reaction in response to an external stimulus.

2. The mesoporous inorganic material as defined in claim 1, which is one selected from the group consisting of silica, titania, zirconia, alumina, silica-alumina, silica-titania, tin phosphate, niobium phosphate, aluminum phosphate, titanium phosphate, and the oxides, nitrides, sulfides, selenides, tellurides, composite oxides and composite salts thereof.

3. The mesoporous inorganic material as defined in claim 1, wherein said external stimulus is at least one selected from the group consisting of light, heat, a radioactive ray, an acid, an alkali, a crosslinking agent, magnetism and an ion.

4. The mesoporous inorganic material as defined in claim 1, wherein said chemical reaction is at least one selected from the group consisting of a dimerization reaction, a multimerization reaction, a polymerization reaction, a condensation reaction, an addition reaction and a complex-formation reaction.

5. The mesoporous inorganic material as defined in claim 1, wherein said functional group is at least one selected from the group consisting of an unsaturated group, a carboxyl group, a hydroxyl group, an amino group, an amide group, an ether group, an ester group, a carbamate group and a silane group.

6. The mesoporous inorganic material as defined in claim 1, which comprises a functional substance filled in said pores, wherein the entrances of said pores are closed by means of the formation of said bond in said functional group.

7. The mesoporous inorganic material as defined in claim 6, wherein said functional substance is at least one selected from the group consisting of a steroid compound, a vitamin compound, a hormone compound, a pharmacologically active compound, a pesticidal compound, a physiologically active compound, an amino acid compound, a saccharide compound, a fatty acid compound and a nucleic acid compound.

8. A method of incorporating and/or removing a chemical substance, comprising the steps of:

preparing a mesoporous inorganic material having an ordered array structure of a plurality of one-dimensional pores, wherein the entrances of said pores have a functional group capable of forming a bond based on a chemical reaction in response to an external stimulus;

incorporating a chemical substance in said pores; and

applying said external stimulus to said mesoporous inorganic material to form a bond in said functional group.

9. A method of controllably releasing a functional substance, comprising the steps of:

preparing a mesoporous inorganic material having an ordered array structure of a plurality of one-dimensional pores, wherein the entrances of said pores have a functional group capable of forming a bond and splitting said bond based on a chemical

reaction in response to an external stimulus, and a functional substance is confined in said pores by means of formation of said bond in said functional group;

applying a first external stimulus to said mesoporous inorganic material to split said bond in said functional group to release said functional substance from said pores;
and

applying a second external stimulus to said mesoporous inorganic material to form said bond in said functional group to discontinue said release of said functional substance.

10. A mesoporous inorganic material having a hexagonal structure, wherein the pores of said mesoporous inorganic material are filled with a functional substance, and the entrances of said pores are closed by a bond formed in an organic functional group.

11. A method of producing a mesoporous inorganic material which has an organic functional group capable of forming a bond based on a chemical reaction in response to an external stimulus, at the entrances of the pores thereof, comprising the steps of:

(1) preparing a mesoporous inorganic material having a hexagonal structure by use of a template comprising a surfactant capable of forming a hexagonal structure in an aqueous solution;

(2) introducing an organic functional group capable of forming a bond based on a chemical reaction in response to an external stimulus, to said mesoporous inorganic material while leaving the surfactant in the pores of said mesoporous inorganic material;
and

(3) removing said surfactant with a solvent.

12. The method as defined in claim 11, which includes the step of subjecting said mesoporous inorganic material to acid treatment between said preparing step (1) and said introducing step (2).

13. A method of incorporating and/or removing a chemical substance, comprising the steps of:

preparing a mesoporous inorganic material having a hexagonal structure, wherein the entrances of the pores thereof have an organic functional group capable of forming a bond based on a chemical reaction in response to an external stimulus;

incorporating a chemical substance into the pores of said mesoporous inorganic material; and

forming a bond in said organic functional group with an external stimulus.